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Erosion relevant topographical parameters derived from different height models - a comparative study from the Indian Lesser Himalayas

Pawanjeet Datta, Helmer Schack-Kirchner, and Martin Maier

Institute of Soil Science and Forest Nutrition, Freiburg University, Freiburg, Germany
(pawan.datta@bodenkunde.uni-freiburg.de, helmer.schack-kirchner@bodenkunde.uni-freiburg.de,
martin.maier@bodenkunde.uni-freiburg.de)

Topography is a crucial surface characteristic in soil erosion modelling studies. Soil erosion models use a digital elevation model (DEM) to derive the topographical characteristics. In a majority of cases, it is incorporated as a given parameter and is not tested extensively in contrast to soil, land use and climate related parameters. However, the data accuracy in case of topographical parameters depends largely on the derivation method and the resolution of the DEM.
This study compares erosion relevant parameters - elevation, slope, aspect and topographical LS-factor computed from three DEMs at original resolutions and a 20m interpolated resolution for a 13 km2 watershed located in the Indian Lesser Himalayas. The DEMs used were a digitized DEM generated from contour lines on a 1:50,000 topographical map, a SRTM DEM at 90m resolution and an ASTER DEM at 15m resolution. The DEM derived topographical parameters were compared with 152 field measurements from the catchment.
Significant differences across the DEMs were observed for all the parameters. The high resolution ASTER DEM was observed to fail for the mountainous watershed. TOPO DEM which is, theoretically, more detailed showed similar behavior to the coarser SRTM DEM in its variability from the field measurements. Field control as well as mixed regression modeling show SRTM DEM to be the DEM of choice for the study area and it was found to be reliable at catchment scale but not at sub-watershed or hillslope scales.

Keywords: soil erosion modelling, DEM, topographical parameters, Lesser Himalaya